PENNSYLVANIA GEOLOGICAL SURVEY
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FIELD TRIP GUIDE

Hummelstown Area
DAUPHIN COUNTY

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF INTERNAL AFFAIRS
Genevieve Blatt, Secretary

ITINERARY

Distance	Mileage	
		Assemble in parking area around Central Dauphin High School.
0.0	0.0	Turn right (west) on Locust Lane.
1.0	1.0	Proceed on Locust Lane until Route 230 underpass has been cleared. Turn right. Stop before entering dual highway (Route 230 By-pass).
0.1	1.1	Turn right on Route 230 By-pass.
0.9	2.0	Note shale outcrops on both sides of the road. This shale is called the Martinsburg Shale. It is approximately 430 million years old, (Upper Ordovician period of geologic time). Like many other things, rocks and minerals suffer changes when they are exposed to the weather. Although these changes are relatively slow, they are evident in the rocks along this highway. The shale near the surface is light brown in color while the same rock is dark gray to black near the base of the road cuts. Weathering of this rock oxidizes the iron minerals present and changes the color from dark gray to brown. Eventually, now that this road has been cut through exposing the fresh unaltered rock, all of the black or dark gray shale you see today will turn brown in color, through the action of weathering.

Distance	Mileage	
1.8	3.8	Outcrops of limestone on both sides of the road. This limestone is also Ordovician in age. We will see limestone again as we cross Swatara Creek in about ten minutes.
0.1	3.9	Stop for red light. Turn left on Route 422.
2.5	6.4	Daves Dream on right is located on shale very similar to and the same age as the shale we saw along Route 230 By-pass.
2.3	8.7	Swatara Creek. Large outcrop of limestone along bank of creek on your right (south). This limestone is called the Beekmantown limestone. It is approximately 480 million years in age. We will see more of this limestone when we arrive at the cave. Indian Echo Cave has been formed in this limestone.
1.0	9.7	Turn right at large sign directing you to the cave.
0.2	9.9	Turn right into private road leading to cave.
0.4	10.3	Stop 1. INDIAN ECHO CAVE

IMPORTANT -

1. Do not break off any stalactites!
2. Keep with your group in the cave.

On the Surface above the Cave -

A. Notice the large collapse-type of sinks. These sinks or sink holes are caused by the dissolving away of a large area of limestone below. The rock "roof" above then collapsed forming broad shallow depressions on the surface.

B. Note the linear position of the signs on the surface. These indicate solution features in the cave below. This is direct evidence of two solution channels, probably along very large right-angle joints in the limestone.. Look at the map of the cave on the last page of this guide and you will see the outline of these right-angle solution channels formed along joints in the limestone.

C. From the entrance of the Cave you can see Swatara Creek. This Creek is the major stream in the area and controls the level of the ground water table. Solution of the rocks could only take place down to the base of this stream level. This is the zone of vadose water. When the creek was flowing at a higher level, solution of the cave began. As the creek cut lower by erosion, it lowered the ground water table and solution progressed downward, enlarging the cave.

D. Notethe coal silt on the creek banks,transported here from the Anthracite area, 40 miles to the northeast.

INDIAN ECHO CAVE - Entrance

Note the bedding and jointing of the limestone at the cave entrance. The bedding is nearly horizontal but overturned almost 180°. Both bedding and jointing planes are rock structures along which solution has taken place most easily.

Just inside the cave entrance - notice the green copper mineral "malachite" on the roof of the cave. Small quantities of copper sulfide minerals were dissolved in the overlying rocks and carried by carbonate-bearing ground water downward to the roof of the cave where these solutions evaporated and precipitated copper carbonate as

the mineral malachite.

INDIAN BALL ROOM

The geologic history of the cave can be effectively outlined using the Ball Room as a model. Two major geologic processes are responsible for this cave: solution, and deposition.

A. Solution

$H_2O + CO_2 \quad H_2CO_3$

$H_2CO_3 + Ca^{++} \quad Ca(HCO_3)_2$

1. Solution began along bedding and joint planes.
2. Solution cracks, along ceiling and walls in the Ball Room are common.
3. Underground streams flowing through the cave also abraded their channels, making potholes.
4. Enlargement of the solution cracks and stream channels proceeded downward and followed along the passageways of easiest access.
5. Practically all this was accomplished in the zone of vadose water.
6. The formation of the cave as you see it today possibly took one to five million years.

B. Deposition

$Ca(HCO_3)_2 \quad CaCO_3 + H_2O$

1. This process could have started as soon as there was a small cavern in the limestone. Solution is much more rapid than deposition.
2. Precipitation took place by two methods:
   a. Evaporation. During this process, carbon dioxide and some

water is lost resulting in a super saturated solution, and precipitation.

b. Lowering of temperature. The cave temperature is about 55 degrees F. in summer, which is cooler than the rocks above. When ground water enters the roof of the cave it is immediately cooled and precipitation of calcium carbonate results.

C. The precipitated matter is calcite and aragonite. Both minerals are calcium carbonate. Aragonite is the most common. It has a radiating fibrous appearance.

D. Deposition is nearly entirely in the Vadose Zone.

Features of Deposition - The following features may be seen throughout the cave.

A. Stalactites - Build downward from the roof.

1. Growth takes place from droplets of water hanging on the roof or on the end of individual stalactites.
2. Growth is around the rim only. They are hollow, when small. When large, they often fill in. You can tell a stalactite from a stalagmite because the stalactite is hollow.
3. The rate of growth of a single stalactite is variable. In this cave, the average rate is about one cubic inch of material per 100 years.

B. Stalagmites - Build upward from the floor.

1. They grow when water falls to the floor and evaporates.
2. They are nearly always solid.
3. Their rate of growth is also variable. They do grow faster than stalactites, however, because the water that drips from the roof

or from stalactites remains in one spot on the floor.

C. Columns - Formed when stalagmites and stalactites join.

D. Flowstone - Coats on walls and forms over irregularities such as broken pieces or rock.

1. Ribbons, sheets, and curtains are variations, describing their appearance.
2. Flowstone accumulates by the evaporation of water trickling into the cave along fractures instead of forming from droplets. Accumulation is more rapid and some have grown in this cave at the rate of one cubic inch in 35 years or 1/2 inch in 17 years.

E. Helictites - Build out horizontally on the walls of the cave or on the sides of stalactites and stalagmites. They represent deposition at the level of the water table, and hence formed when the water table was higher than its present level.

Special Features

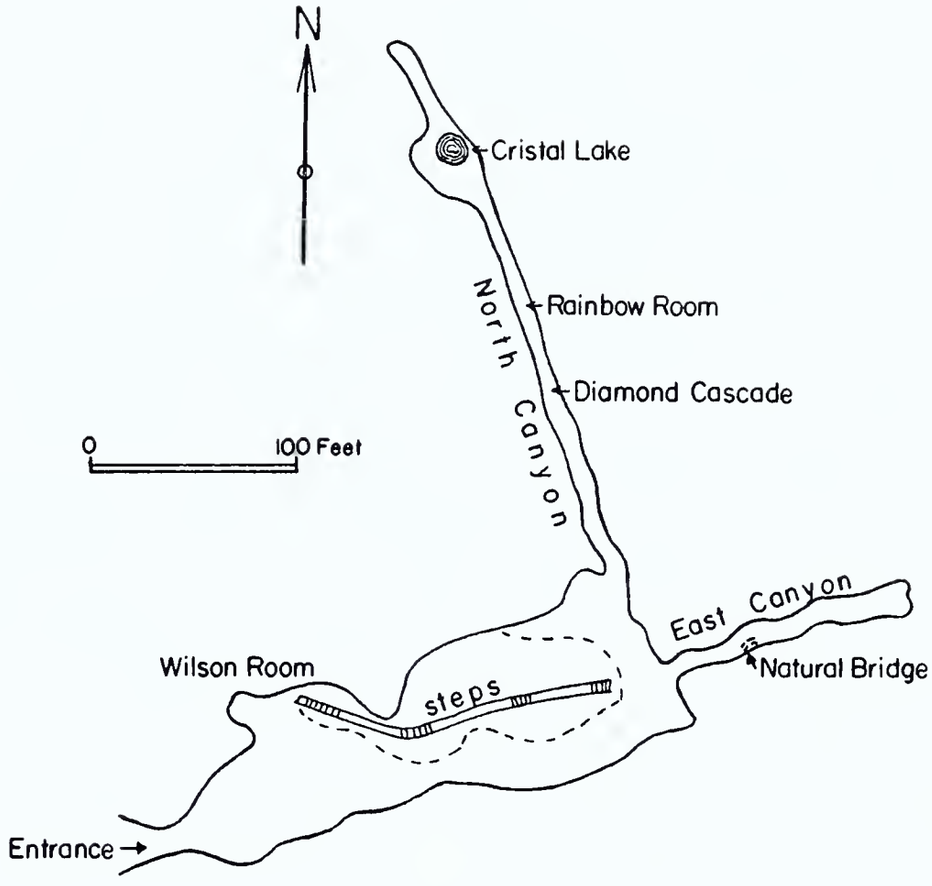
A. Natural Bridge - caused by differential solution. The softer material is leached out of the more resistant mineral matter.

B. Crystal Lake - This is a perched water table lake. There are an insufficient number of fractures in the limestone below the lake to drain off the water; hence, it remains hanging above the present water table.

C. North Canyon - This canyon is caused by extensive solution in one direction. This direction is controlled by joints in the limestone.

D. Colors in the Flowstone or Dripstone.

1. Black- from fires.
2. Red- from disseminated iron oxide (ferric state)
3. Gray- fresh dripstone covering old, dirty or black areas.
4. Tan and yellow - iron oxide (ferrous and ferric).



Map of Indian Echo Cave